Comparing Weed Weed Suppression in No-Till and Conventionally Tilled Pumpkin Systems that Utilize Stale Seedbed Techniques and Transplants

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Introduction

Pumpkins are produced on 6,000 to 7,000 acres in New York State; and are worth $17 to 20 million annually (Crop Profiles of 15 New York Vegetables, 1999). Pumpkin acreage has steadily increased throughout the Northeast because of strong local demand for the crop and increased opportunities to ship pumpkins outside the region. Pests of pumpkins are numerous and difficult to control, however, and the strategies that provide the best pest control are relatively costly. Because profit margins are narrow, pumpkin growers are seeking ways to contain costs.

Reduced-tillage vegetable systems that utilize cover crops as mulches have been under investigation for many years. These systems have been reported to increase profitability, enhance soil quality and reduce pesticide applications. Nevertheless, growers in New York have been reluctant to utilize reduced-tillage systems on their farms because of the difficulty of achieving good crop stands in high residue environments, the fear of crop yield reductions or delays because of cold soils, the lack of appropriate equipment and expertise, and the unpredictability of weed control.

Cover crops used as mulches have proven valuable in weed suppression. Mulches function as a physical barrier to weeds, and suppress weeds through allelopathic interference. Moreover, mulches suppress weeds by altering the quantity and quality of light reaching the soil surface, and by affecting the soil temperature, moisture, and chemical environment. The elimination of tillage also lowers weed pressure, mainly by reducing weed seed germination. The suppression of weeds in no-till/cover cropping systems is often short-lived, usually lasting less than 4 weeks. Winter rye has been shown to suppress weeds in numerous vegetable crops, including no-till pumpkins. Growers have not used this system, however, because they have been unable to achieve satisfactory season-long weed control. More work is needed to develop effective weed control strategies.

Transplants are most often used in vegetable production to facilitate early crop maturation in a short growing season or where weed control when direct-seeding is inadequate. Transplanted vegetables are more competitive against weeds than direct-seeded vegetables. A later planting date also allows the soil to warm, providing warm-loving plants with conditions better suited to optimal growth, and provides no-till growers with the opportunity to plant when the cover crop has grown to a more weed suppressive stage. The later planting afforded by transplanting also provides an opportunity to utilize stale seedbed weed management techniques. In no-till pumpkin production, the benefits of superior plant stands, more effective pest management and higher yields may outweigh the costs and inconvenience associated with using transplants.

Objectives

The primary objectives of this research were a) to learn whether a strategy that combines the use of transplants and the creation of a stale seedbed in a reduced-tillage system offers improved weed control when compared to direct seeding, and b) to learn whether a stale seedbed/transplanting strategy is more weed suppressive when used in a no-till/cover crop system than when used in a conventional tillage system (i.e., to learn the contribution of the cover crop in suppressing weeds).

Materials and Methods

Four treatments were replicated three times in each of two tillage systems: reduced-tillage/rye and conventional tillage. Treatments included: 1) direct-seeded Howden, 2) transplanted Howden, 3) direct-seeded Rocket, and 4) transplanted Rocket. The rye was flail-mowed in mid-June, and stood about 72" tall. Plots were 30' long, and contained four rows each on 66" centers. Plants were spaced 24" apart in the row. Rye plots were readied for planting by making a slot with a flutted coulter followed by a narrow shank. Transplanted Howden treatments were seeded in the greenhouse on 6/1/00 and transplanted on 6/19/00. Direct seeding of Howden also occurred on 6/19/00. Rocket transplants were seeded on 6/8 and set in the field on 6/26/00. Field seeding of Rocket also took place on 6/26/00. Weed cover evaluations were made on 8/9/00, and Harvest evaluations were made on 9/26/00.

Results and Discussion

Stale seedbed treatments were not used because the cold season delayed the emergence of annual weeds. Weed cover at the time of planting was less than 1% in rye plots. Weeds grew quickly after plant establishment, however, particularly in the row, where soil disturbance took place. On 8/9/00, approximately 6 weeks after crop establishment, weed cover was evaluated (see Table 1). Weed cover was greater in reduced-tillage than in conventional tillage, regardless of the method of plant establishment or variety. Conventionally tilled plots were cultivated twice. As has been frequently reported, the rye was only weed-suppressive for a brief period of time. Pumpkin cover (a measure of the rate of pumpkin growth) was greater in conventionally tilled plots, and, generally greater in direct-seeded plots.

Table 1. Weed and ground cover (%) in reduced-tillage and conventionally tilled pumpkins at the Waldbillig Farm on August 9, 2000.

Treatment	Weed Cover	Pumpkin Cover	Rye Cover	Bare Ground
HTR	48.3	45.7	6.0	
HSR	39.3	58.3	2.3	
RTR	29.0	67.7	3.3	
RSR	34.7	62.3	3.0	
HTB	30.0	65.6		4.3
HSB	21.7	77.3		1.0
RTB	26.0	71.7		2.3
RSB	11.7	86.7		1.6

Key: Howden (H), Rocket (R), Transplanted (T), Seeded (S), Rye (R), Bare Ground (B)

Howden yields were greatest in conventionally tilled plots, regardless of the method of plant establishment (see Table 2). Howden transplanting yielded more pumpkins than direct-seeding, regardless of tillage. Howden, a long-season variety, probably benefited from the relatively warmer soils under conventional tillage, and the "jump start" provided by transplanting. Rocket yields, on the other hand, were greatest in reduced-tillage, regardless of the method of establishment, and generally higher when direct-seeded. Rocket, which is a relatively short-season variety, appears well-suited to reduced-tillage production.

Table 2. Pumpkin yields at the Waldbillig Farm using reduced-tillage and conventional tillage in 2000.

Treatment	Pumpkin Numbers (Orange)	Pumpkin Numbers (Green)	Marketable Pumpkin Weights	Average Pumpkin Weights
HTR	30.3	4.6	337.9	12.6
HSR	34.0	8.3	260.2	10.5
RTR	53.7	5.7	433.8	9.0
RSR	61.3	3.3	571.8	9.8
HTB	30.3	5.7	393.0	15.9
HSB	29.0	7.0	312.7	14.4
RTB	44.7	7.0	385.9	10.2
RSB	42.7	2.7	452.5	11.3

Key: Howden (H), Rocket (R), Transplanted (T), Seeded (S), Rye (R), Bare Ground (B)

Transplanting may be a better option than direct-seeding when establishing a pumpkin crop in a cold soil, such as that under a rye mulch, or when making an early planting of a long-season variety such as Howden. Future research should include a more detailed investigation of the advantages and disadvantages of transplanting pumpkins, particularly in a no-till environment. Research in no-till pumpkin weed management should focus on the suppression of weeds that emerge 4 to 6 weeks after crop establishment.